



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/509,955	06/02/2005	Souvik Banerjee	M03A446/PCT/US	7752
39670	7590	10/18/2007	EXAMINER	
BOC, INC.			BLAN, NICOLE R	
575 MOUNTAIN AVE			ART UNIT	
MURRAY HILL, NJ 07974-2064			PAPER NUMBER	
			1792	
			MAIL DATE	
			10/18/2007	
			DELIVERY MODE	
			PAPER	

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

## Office Action Summary

**Application No.**

10/509,955

**Applicant(s)**

BANERJEE ET AL.

**Examiner**

Nicole Blan

**Art Unit**

1762

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 04 October 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 04 October 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>05022005</u> . | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Objections*

1. Claim 14 is objected to because of the following informalities: The unit, angstroms, for the thickness of the high vapor pressure liquid should be Å, not Δ. Appropriate correction is required.

### *Claim Rejections - 35 USC § 112*

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 1, 14, and 18-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1: High vapor pressure is a relative term. How high is the high pressure (i.e. what is the lower limit in order to be considered high pressure)? All gases can be reactive – what constitutes a reactive gas in regards to the Applicants' invention? Furthermore, what is the intended definition of cryogenic cleaning? Is it cleaning with solid pellets or merely cleaning at very low temperatures (e.g. below -50°C) [see Webster for the definition]? For the purpose of examination, the Examiner has provided rejections that read on both of the possible definitions of cryogenic cleaning.

Claim 14: High vapor pressure is a relative term. How high is the high pressure (i.e. what is the lower limit in order to be considered high pressure)?

Claim 18: Low pressure is a relative term. How low is the low pressure? What is the upper limit in order to be considered low pressure?

Claim 19: "Clean dry air" – what constitutes clean air? Is it filtered first or is it atmospheric air?

Claim 20: What is implied by the phrase "free radical initiator?" In general, plasma is not usually regarded as a free radical initiator, but is used as the reactive specie. For the purpose of examination, the Examiner is taking the phrase "free radical initiator" to mean plasma.

***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

5. Claims 1-2, 4-7, 12-13 and 15-16 are rejected under 35 U.S.C. 102(b) as being anticipated by Rose et al. (U.S. Patent 5,931,721, hereafter Rose '721).

Claims 1-2: A process for the removal of contaminants from a surface of a substrate requiring precision cleaning, comprising the steps of: (a) applying at least one fluid to the substrate surface, the fluid selected from the group consisting of a high vapor pressure liquid, a reactive gas, and vapor of a reactive liquid; and (b) cryogenically cleaning the surface of the substrate while (a) and (b) are carried out simultaneously [col. 3, lines 29-33; col. 10, lines 18-58].

Claims 4-5, 12-13, and 15: Rose '721 teaches that the high vapor pressure fluid can be methanol, which inherently has a vapor pressure greater than about 5 kPa at 25°C, a freezing point below about -50°C, a dipole moment greater than 1.5 D, and is considered to be a drying agent [col. 2, lines 62-67; col. 3, lines 1-2].

Art Unit: 1792

Claims 6-7: Rose '721 teaches that at least one fluid is a reactive gas or vapor such as ozone [col. 14, lines 26-33].

Claim 16: The process of claim 1 wherein the substrate surface is a semiconductor, metal or dielectric film [col. 1, lines 1-7].

6. Claims 1, 3, 6-7, 16, and 18-21 are rejected under 35 U.S.C. 102(b) as being anticipated by Starov et al. (U.S. Patent 6,333,268, hereafter Starov '268).

Claims 1, 3, and 16: A process for the removal of contaminants from a surface of a substrate [i.e. semiconductors] requiring precision cleaning, comprising the steps of: (a) applying at least one fluid to the substrate surface, the fluid selected from the group consisting of a high vapor pressure liquid, a reactive gas, and vapor of a reactive liquid; and (b) cryogenically cleaning [the dense fluid treatment is taken to mean cryogenically clean because it is done at a temperature lower than  $-50^{\circ}\text{C}$ ] the surface of the substrate while (a) and (b) are carried out sequentially [col. 3, lines 11-15].

Claims 6-7: Starov '268 teaches using a mixture of  $\text{NF}_3$  and  $\text{O}_2$  [col. 7, lines 24-25].

Claim 18: Starov '268 teaches that the reactive gas is introduced into the process at a temperature of about  $30^{\circ}\text{C}$  [col. 7, lines 32-33].

Claim 19: Starov '268 teaches purging the chamber with nitrogen [col. 27, lines 10-13].

Claims 20-21: Starov '268 teaches that the reactive gas is applied in the presence of a free radical initiator, plasma [col. 7, lines 10-25]. It is noted that strictly speaking plasma is not usually regarded as a free radical initiator, but is used as the reactive specie.

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. Claims 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rose '721 as applied to claim 1 above, and further in view of Kuyel (U.S. PGPub 2003/0010356, hereafter Kuyel '356).

Claims 10-11: Rose '721 teaches the limitations of claim 1 above. It does not explicitly teach the size of the contaminants. However, Kuyel '356 teaches that it is conventional to clean a substrate [i.e. workpiece] to remove particulates and residues down to 0.05 micrometers. It would have been obvious to one of ordinary skill in the art at the time the invention was made to clean a substrate with particles less than 0.76 and 0.13 micrometers if it is conventional to remove all residues greater than 0.05 micrometers.

Art Unit: 1792

10. Claims 1, 3, 6-9, 14, and 16-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Starov et al. (U.S. Patent 6,333,268, hereafter Starov '268), and in view of Rose '721.

Claims 1, 3, and 16: Starov '268 teaches a method of removing residues [i.e. contaminants] by applying a reactive gas to the surface of the substrate [i.e. semiconductors, col. 1, lines 11-15] followed by a dense fluid treatment [i.e. sequentially]. It does not explicitly disclose that the dense fluid treatment is a cryogenic method. However, Rose '721 teaches that a densified fluid containing solid carbon dioxide can be used to clean substrates [col. 3, lines 29-37; col. 10, lines 18-58]. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the densified fluid of '721 as the densified fluid of '268 with a reasonable expectation of success because '721 teaches that solid particles of carbon dioxide with in a fluid remove photoresist layers from substrates [col. 3, lines 35-37]. The combination of Starov '268 and Rose '721 teaches more than one method of cleaning a substrate. The first method teaches the method of Starov' 268 [i.e. applying a reactive gas followed by a dense fluid treatment] followed by a cryogenic cleaning method, which provides proper motivation because Rose'721 teaches that a densified fluid can be used to remove photoresist. The second method teaches substituting the cryogenic cleaning method in for the dense fluid treatment step as was discussed in detail above.

Claims 6-7: Starov '268 and Rose '721 teach the limitations of claim 1 above. '268 teaches using a mixture of  $\text{NF}_3$  and  $\text{O}_2$  [col. 7, lines 24-25].

Claim 8-9: Starov '268 and Rose '721 teach the limitations of claim 1 above. They do not explicitly teach contacting the surface for either up to 10 minutes or less than 2 minutes prior to the cryogenic cleaning. It would have been obvious to one having ordinary skill in the art at

Art Unit: 1792

the time the invention was made to contact the surface for either up to 10 minutes or less than 2 minutes prior to the cryogenic cleaning because Starov '268 teaches that the time required to remove contaminants from a substrate is a result effective variable [col. 26, lines 61-67; col. 27, lines 1-10], since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claim 14: Starov '268 and Rose '721 teach the limitations of claim 1 above. As discussed in claim 1, Starov '268 teaches a plasma treatment followed by a densified fluid treatment to remove photoresist layers from substrates along with Rose '721 teaching cryogenic cleaning in order to remove photoresist layers from substrates. It would have been obvious to a person of ordinary skill in the art to use the cryogenic cleaning method of Rose '721 in conjunction with the method of Starov '268 in an attempt to provide an improved cleaning method for removing photoresist layers from substrates, as a person with ordinary skill has good reason to pursue the known options within his or her technical grasp. In turn, because the method of cleaning as claimed has the properties predicted by the prior art, it would have been obvious to clean with the method of Starov '268 followed by the cryogenic cleaning of Rose '721. They do not explicitly teach contacting the surface for either up to 10 minutes or less than 2 minutes prior to the cryogenic cleaning or that the layer of solution is at least 5 angstroms thick. It would have been obvious to one having ordinary skill in the art at the time the invention was made to contact the surface for either up to 10 minutes or less than 2 minutes prior to the cryogenic cleaning or to have a layer of solution at least 5 angstroms thick, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the



Art Unit: 1792

optimum or workable ranges involves only routine skill in the art. *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Claims 17: Starov '268 and Rose '721 teach the limitations of claim 1 above. Starov '268 teaches that at least one fluid is a reactive, as described above in claim 1, is in contact with a surface of a substrate for a predetermined time [see explanation in claims 8-9 above], and removing the gaseous byproduct [via a purge stream; col. 27, lines 10-13] prior to the dense fluid treatment step [i.e. cryogenic cleaning; see discussion of claim 1 above].

Claim 18: Starov '268 and Rose '721 teach the limitations of claim 17 above. Starov '268 teaches that the reactive gas is introduced into the process at a temperature of about 30°C [col. 7, lines 32-33].

Claim 19: Starov '268 and Rose '721 teach the limitations of claim 18 above. Starov '268 teaches purging the chamber with nitrogen [col. 27, lines 10-13].

Claims 20-21: Starov '268 and Rose '721 teach the limitations of claim 17 above. Starov '268 teaches that the reactive gas is applied in the presence of a free radical initiator, plasma [col. 7, lines 10-25].

11. Claims 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Starov '268 and Rose '721 as applied to claim 1 above, and further in view of Kuyel (U.S. PGPub 2003/0010356, hereafter Kuyel '356).

Claims 10-11: Starov '268 and Rose '721 teach the limitations of claim 1 above. They do not explicitly teach the size of the contaminants. However, Kuyel '356 teaches that it is conventional to clean a substrate [i.e. workpiece] to remove particulates and residues down to 0.05 micrometers. It would have been obvious to one of ordinary skill in the art at the time the

Art Unit: 1792

invention was made to clean a substrate with particles less than 0.76 and 0.13 micrometers if it is conventional to remove all residues greater than 0.05 micrometers.

### ***Double Patenting***

12. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

13. Claims 1-3, 6-9, 11, and 16-21 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-5, 7-8, 11, 13-14, and 21-22 of U.S. Patent No. 6,949,145. Although the conflicting claims are not identical, they are not patentably distinct from each other because, for example, claim 1 of the conflicting patent substantially recites the manipulative steps by claims 1 and 6-7 of the instant application. Similarly, claim 2 of the conflicting patent substantially recites the manipulative steps by claim 2 of the instant application. Similarly, claims 3-4 of the conflicting patent substantially recites the manipulative steps by claim 3 of the instant application. Similarly, claim 16 of the conflicting patent substantially recites the manipulative steps by claim 5 of the instant application. Similarly, claim

Art Unit: 1792

7 of the conflicting patent substantially recites the manipulative steps by claim 11 of the instant application. Similarly, claim 8 of the conflicting patent substantially recites the manipulative steps by claims 8-9 of the instant application. Similarly, claim 11 of the conflicting patent substantially recites the manipulative steps by claim 18 of the instant application. Similarly, claim 13 of the conflicting patent substantially recites the manipulative steps by claim 20 of the instant application. Similarly, claim 14 of the conflicting patent substantially recites the manipulative steps by claim 21 of the instant application. Similarly, claim 21 of the conflicting patent substantially recites the manipulative steps by claim 1 of the instant application. Similarly, claim 22 of the conflicting patent substantially recites the manipulative steps by claims 17 and 19 of the instant application.

14. Claims 1-5, 8-9, and 12-15 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1, 3-11, and 13 of U.S. Patent No. 6,852,173. Although the conflicting claims are not identical, they are not patentably distinct from each other because, for example, claim 1 of the conflicting patent substantially recites the manipulative steps by claim 1 of the instant application. Similarly, claim 3 of the conflicting patent substantially recites the manipulative steps by claim 2 of the instant application. Similarly, claims 4-5 of the conflicting patent substantially recites the manipulative steps by claim 3 of the instant application. Similarly, claim 6-7 of the conflicting patent substantially recites the manipulative steps by claim 12 of the instant application. Similarly, claim 8 of the conflicting patent substantially recites the manipulative steps by claim 13 of the instant application. Similarly, claim 9 of the conflicting patent substantially recites the manipulative steps by claims 4-5 of the instant application. Similarly, claim 10 of the conflicting patent substantially recites

Art Unit: 1792

the manipulative steps by claim 14 of the instant application. Similarly, claim 11 of the conflicting patent substantially recites the manipulative steps by claims 8-9 of the instant application. Similarly, claim 13 of the conflicting patent substantially recites the manipulative steps by claim 15 of the instant application.

### ***Conclusion***

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Yates (U.S. Patent 6,350,322), Webster's New World Dictionary, Felder et al. (Elementary Principles of Chemical Processes), and Snow et al. (Chemical Detection with a Single-Walled Carbon Nanotube Capacitor).


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nicole Blan whose telephone number is 571-270-1838. The examiner can normally be reached on Monday - Thursday 8-5 and alternating Fridays 8-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on 571-272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1792

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

NRB

  
ALEXANDER MARKOFF  
PRIMARY EXAMINER